MULTI-DIMENSIONAL RENDERING

CROSS-REFERENCE TO RELATED APPLICATIONS BACKGROUND

[0001] This application claims priority to U.S. Provisional Application Ser. No. 62/907,745 entitled MULTI-DIMENSIONAL RENDERING, filed on Sep. 30, 2019, the contents of which are incorporated fully herein by reference.

BACKGROUND

[0002] Computing devices, such as wearable devices, including portable eyewear devices (e.g., smartglasses, headwear, and headgear); mobile devices (e.g., tablets, smartphones, and laptops); and personal computers available today integrate image displays and cameras. Currently, users of computing devices can utilize photo filters to create effects on images. Various photo decorating applications feature tools like stickers, emojis, and captions to edit the images.

DRAWINGS

[0003] The drawing figures depict one or more implementations, by way of example only, not by way of limitations. In the figures, like reference numerals refer to the same or similar elements.

[0004] FIG. **1**A is a right side view of an example hardware configuration of an eyewear device utilized in a photo filter (e.g., multi-dimensional) light field effect system, in which images from multiple dimensions (e.g., right, left, up, and down) are blended to enable rendering in multiple dimensions.

[0005] FIG. **1**B is a top cross-sectional view of a right chunk of the eyewear device of FIG. **1**A depicting a right visible light camera of a depth-capturing camera, and a circuit board.

[0006] FIG. **1**C is a left side view of an example hardware configuration of an eyewear device of FIG. **1**A, which shows a left visible light camera of the depth-capturing camera.

[0007] FIG. **1**D is a top cross-sectional view of a left chunk of the eyewear device of FIG. **1**C depicting the left visible light camera of the depth-capturing camera, and the circuit board.

[0008] FIG. **2**A is a left side view of another example hardware configuration of an eyewear device utilized in the photo filter (e.g., multi-dimensional) light field effect system, which shows the right visible light camera and a depth sensor of the depth-capturing camera to generate a depth image.

[0009] FIGS. **2**B and **2**C are rear views of example hardware configurations of the eyewear device, including two different types of image displays.

[0010] FIG. **3** shows a rear perspective sectional view of the eyewear device of FIG. **2**A depicting an infrared camera of the depth sensor, a frame front, a frame back, and a circuit board.

[0011] FIG. **4** is a cross-sectional view taken through the infrared camera and the frame of the eyewear device of FIG. **3**.

[0012] FIG. **5** shows a rear perspective view of the eyewear device of FIG. **2**A depicting an infrared emitter of the depth sensor, the infrared camera of the depth sensor, the frame front, the frame back, and the circuit board.

[0013] FIG. **6** is a cross-sectional view taken through the infrared emitter and the frame of the eyewear device of FIG. **5**.

[0014] FIG. **7** depicts an example of a pattern of infrared light emitted by the infrared emitter of the depth sensor and reflection variations of the emitted pattern of infrared light captured by the infrared camera of the depth sensor of the eyewear device to measure depth of pixels in a raw image to generate the depth image.

[0015] FIG. **8**A depicts an example of infrared light captured by the infrared camera of the depth sensor as an infrared image and visible light captured by a visible light camera as a raw image to generate the depth image of a three-dimensional scene.

[0016] FIG. **8**B depicts an example of visible light captured by the left visible light camera as left raw image and visible light captured by the right visible light camera as a right raw image to generate the depth image of a three-dimensional scene.

[0017] FIG. **8**C depicts an example of images in multiple dimensions (e.g., left, right, up, and down).

[0018] FIG. **9** is a high-level functional block diagram of an example photo filter (e.g., multi-dimensional) light field effect system including the eyewear device with a depth-capturing camera to generate an artistic effect image for rendering in multiple dimensions and a user input device (e.g., touch sensor), a mobile device, and a server system connected via various networks.

[0019] FIG. **10** shows an example of a hardware configuration for the mobile device of the photo filter (e.g., multi-dimensional) light field effect system of FIG. **9**, which includes a user input device (e.g., touch screen device) to receive mark-up and an image selection to transfer to a raw image or a processed image to generate a photo filter effect image.

[0020] FIG. **11**A is a flowchart of a method that can be implemented in the photo filter (e.g., multi-dimensional) light field effect system to apply to a raw image or a processed image to generate a photo filter artistic effect image for rendering in multiple dimensions.

[0021] FIG. **11**B is a flow chart of a method for creating an artistic image for rendering in multiple dimensions.

[0022] FIG. **11**C is a flow chart for rending an artistic image in multiple dimensions.

[0023] FIG. **12**A illustrates an example of a first presented original image, which is a processed (e.g. rectified) image.

[0024] FIG. **12**B illustrates an example of the first presented original image with markups by a user.

[0025] FIG. **12**C illustrates an example of a first photo filter (e.g., stylized painting effect) image created from the first presented original image of FIG. **12**A for use in a first dimension.

[0026] FIG. **12**D illustrates an example of a second photo filter (e.g., stylized painting effect) image created from the first photo filter image of FIG. **12**A for use in a second dimension.

[0027] FIG. **12**E illustrates an example of a first photo filter (e.g., multi-dimensional) light field effect image generated from the photo filter image of FIG. **12**B, in which the spatial movement or rotation and transitional aspect is skewed to the left and down.

[0028] FIG. **12**F illustrates an example of a second photo filter (e.g., multi-dimensional) light field effect image gen-